Remarks

Claims 1-19 are pending in the application. Claims 1-8 and 10-19 are rejected. Claim 9 is objected to. All rejections and objections are respectfully traversed.

The specification and claim 9 are amended to correct informalities.

Claims 12 and 13 are canceled as they are duplicates of claims 7 and 10, respectively.

The claimed invention applies a three dimensional dual-tree discrete wavelet transform to a video to generate a plurality of sequences of wavelet coefficients having spatial *and* temporal correlation. The plurality of sequences is compressed to produce a compressed bitstream corresponding to the video.

Claims 1 and 4 are rejected under 35 U.S.C. 102(b) as being anticipated by Sivaramakrishnan et al., “A Uniform Transform Domain Video Codec based on Dual Tree Complex Wavelet Transform” (Sivaramakrishnan).

Sivaramakrishnan presents a method for motion estimation in the transform domain, see Abstract. In order to avoid an inverse transformation for motion estimation in the spatial domain, Sivaramakrishnan uses a two dimensional dual-tree complex wavelet transform that allows prediction of transform coefficients from the corresponding coefficients in the previous frame.

Unlike the claimed invention, the output of Sivaramakrishnan's transform is two dimensional and is not spatially *and* temporally correlated.

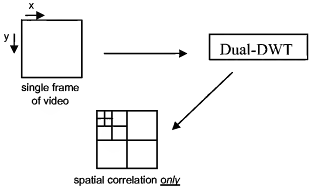
The method described by Sivaramakrishnan does not apply a three dimensional dual-tree discrete wavelet transform to a video. The dual-tree complex wavelet transform of Sivaramakrishnan is two dimensional and is applied only to each 2D frame of the video, see Abstract: "The DT CWT is a multiresolution fine-to-coarse bandpass filtered decomposition of *each still frame…*" and page 3, right column, paragraph 4: "*In 2-D*, since we have six subbands from the DT CWT decomposition…" (emphasis added).

Furthermore, Sivaramakrishnan does not teach a plurality of three dimensional sequences of wavelet coefficients. As the dual-tree complex wavelet transform in Sivaramakrishnan is two dimensional, the results of applying that transform *cannot* be three dimensional. Again, the stated purpose of Sivaramakrishnan's method is to perform motion estimation in the transform domain. Sivaramkrishnan predicts the transform coefficients of each frame from the coefficients of the previous frame. The results (the coefficients) of Sivaramakrishnan's transform do not have a third dimension (e.g., time).

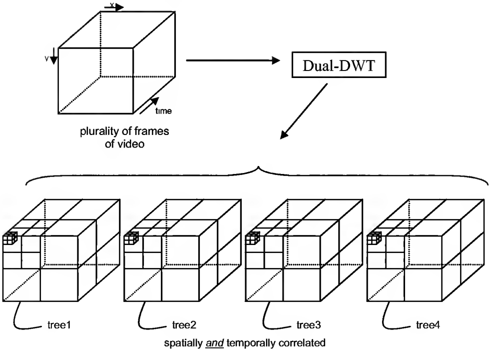
Also, Sivaramakrishnan does not teach three dimensional sequences of wavelet coefficients *having spatial and temporal correlation*. Sivaramakrishnan applies a DT CWT to every frame separately. Therefore, the output of his transform cannot be temporally correlated. The claimed invention, on the other hand, applies a three dimensional dual-tree discrete

wavelet transform *to a video* (i.e., as opposed to each frame separately) resulting in a plurality of three dimensional sequences of wavelet coefficients having spatial *and* temporal correlation. These differences between the method of Sivaramakrishnan and the claimed invention can be pictorially represented as follows:

SIVARAMAKRISHNAN



CLAIMED INVENTION (FIG. 5)



As Sivaramakrishnan does not teach a three dimensional dual-tree discrete wavelet transform or three dimensional sequences of wavelet coefficients having spatial and temporal correlation, it cannot anticipate the claimed invention. Applicants respectfully request that the Examiner withdraw his rejection under 35 U.S.C. 102(b).

Claims 2, 5, 6 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sivaramakrishnan in view of Malvar, U.S. Patent No. 6,477,280 (Malvar).

Malvar describes a method for adaptive encoding and decoding of decomposed coefficients. Malvar itself does not describe any wavelet transform.

Neither Sivaramakrishnan nor Malvar, either alone or in combination, teach a three dimensional dual-tree discrete wavelet transform or three dimensional sequences of wavelet coefficients having spatial and temporal correlation. Therefore, the combination of the references cannot make the claimed invention obvious.

Claims 2, 3, 6, 10, 11, 13, 14 and 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sivaramakrishnan in view of Marusic et al., "A Matching Pursuit Enhanced Three-Dimensional Wavelet Transform Coder" (Marusic).

As was shown above, Sivaramakrishnan does not teach a three dimensional dual-tree discrete wavelet transform or three dimensional sequences of wavelet coefficients having spatial and temporal correlation.

Additionally, Marusic clearly does not teach a three dimensional wavelet transform. The transforms in Marusic are first temporal and then spatial, commonly known in the art as "t + 2D," see page 483. Marusic describes a first "motion compensated temporal transform" (itself accomplished in two stages) and a following "two-dimensional (spatial) wavelet transform" performed on the "subbands resulting from the motion compensated temporal transform." In fact, Marusic explicitly states at page 483 that his process is a "motion compensated transform followed by a 2D wavelet transform." This multi-step process described in Marusic is not equivalent to the three-dimensional dual-tree discrete wavelet transform as claimed, see Specification, page 8.

Furthermore, Marusic is focused on *removing* temporal and spatial correlation while the claimed invention exploits these correlations for improved coding efficiency. As the process of Marusic removes temporal and spatial correlation, Marusic cannot teach sequences of wavelet coefficients having spatial and temporal correlation.

Neither Sivaramakrishnan nor Marusic, either alone or in combination, teach a three dimensional dual-tree discrete wavelet transform or three dimensional sequences of wavelet coefficients having spatial and temporal

correlation. Therefore, the combination of the references cannot make the claimed invention obvious.

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sivaramakrishnan in view of Marusic, and further in view of Chai, U.S. Patent No. 6,137,915 (Chai).

Chai describes a method for error concealment in coding and decoding of decomposed coefficients. Chai itself does not describe any wavelet transform.

Sivaramakrishnan, Marusic and Chai, either alone or in combination, do not teach a three dimensional dual-tree discrete wavelet transform or three dimensional sequences of wavelet coefficients having spatial and temporal correlation. Therefore, the combination of the references cannot make the claimed invention obvious.

Claims 7, 8 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sivaramakrishnan in view of Marusic, and further in view of Craven et al., U.S. Patent No. 6,664,913 (Craven).

Craven describes a method for coding wavefrom data. Craven itself does not describe any wavelet transform.

Sivaramakrishnan, Marusic and Craven, either alone or in combination, do not teach a three dimensional dual-tree discrete wavelet transform or three

dimensional sequences of wavelet coefficients having spatial and temporal correlation. Therefore, the combination of the references cannot make the claimed invention obvious.

It is believed that this application is now in condition for allowance. A notice to this effect is respectfully requested. Should further questions arise concerning this application, the Examiner is invited to call Applicants' attorney at the number listed below. Please charge any shortage in fees due in connection with the filing of this paper to Deposit Account 50-0749.

Respectfully submitted,
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